Radiometric Calibration Validation of the Hyperion Instrument using Ground Truth at a Site in Lake Frome, Australia

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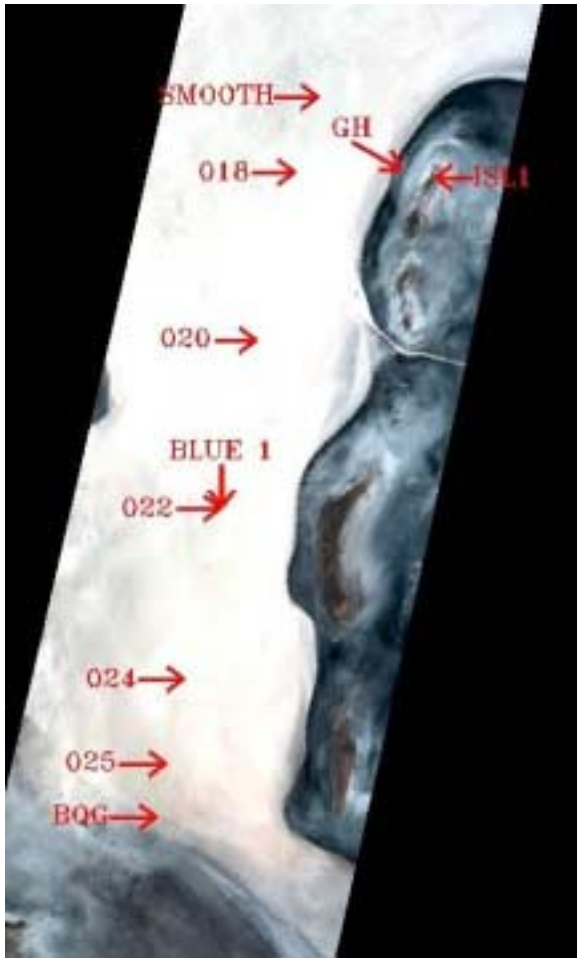

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Presented by: Dr. Pamela Barry

Introduction

Lake Frome Calibration Site

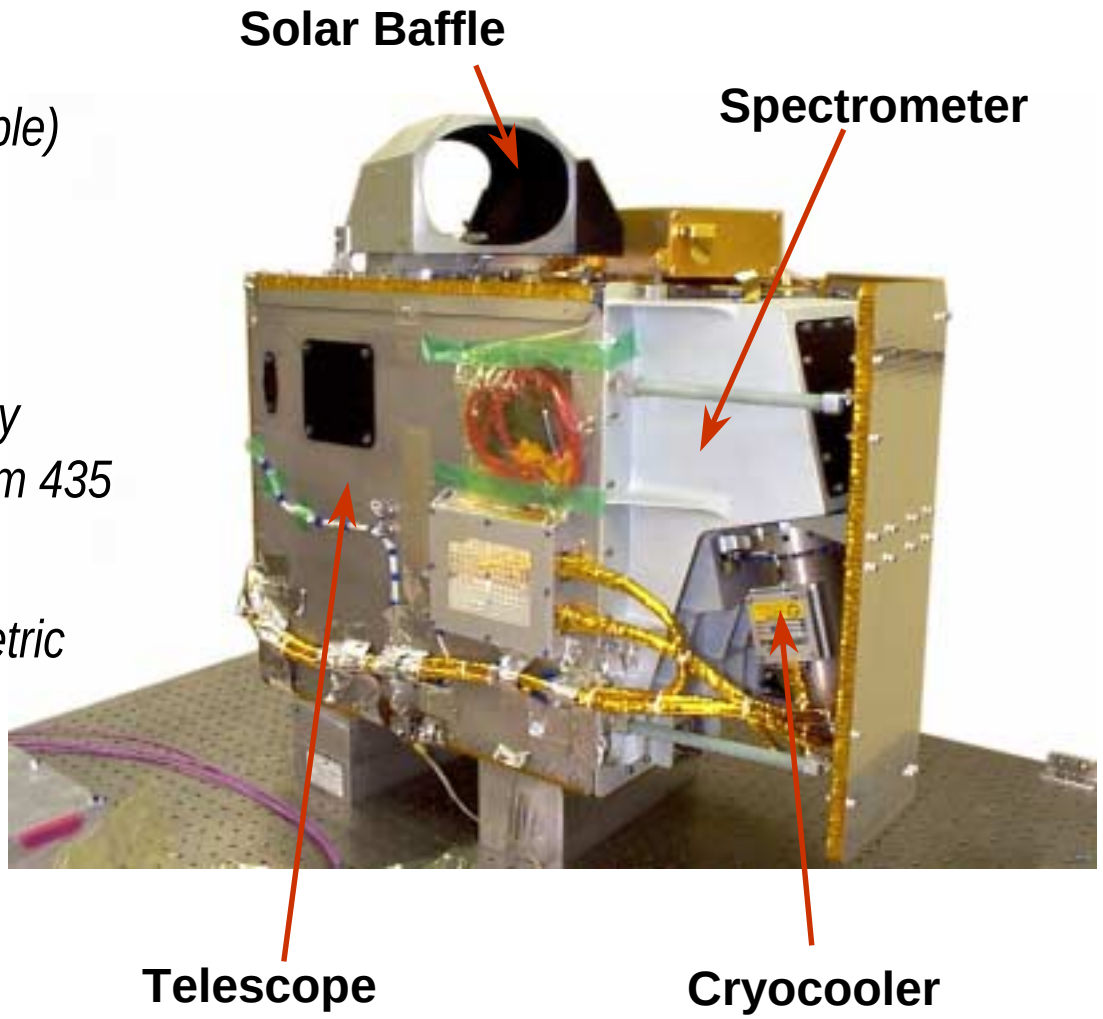
Calibration Approach

Lake Frome Ground Truth Process for Comparison

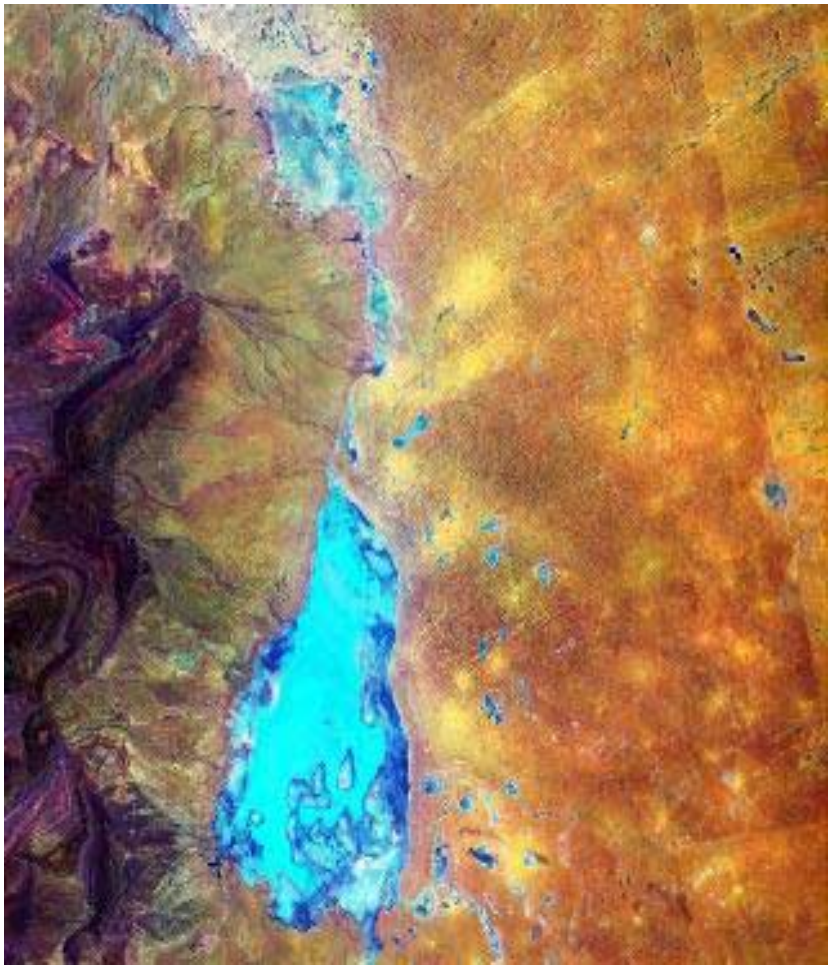
Results of Comparison and Contribution to Early Performance Verification

Hyperion Image Overview

- *7.7 km swath width*
- *160 km swath length (time variable)*
- *30 meter spatial resolution*
- *10 nm spectral resolution*
- *200 radiometrically and spectrally calibrated continuous bands from 435 nm to 2400 nm*
- *Better than 6% absolute radiometric accuracy*

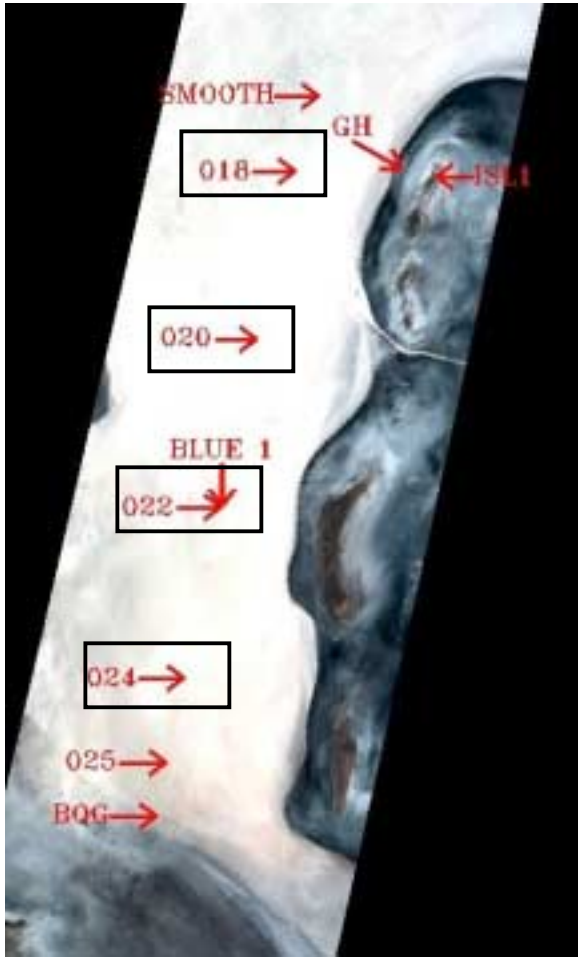


Images of Lake Frome



Dean Graetz, EOC

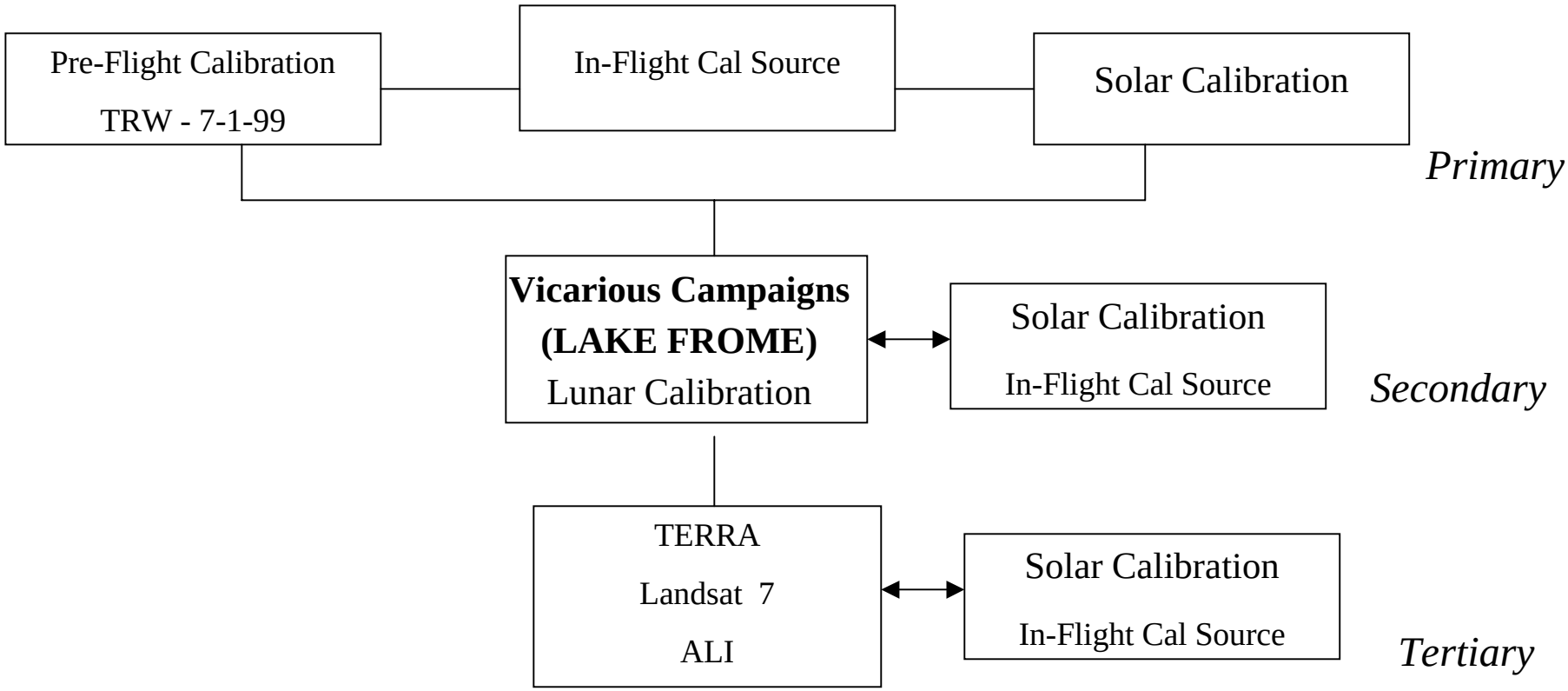
Images of Lake Frome



The Locusts that did not make it over

Calibration signature
Or
New culinary delicacy?

Hyperion Radiometric Calibration



Pre-Flight calibration tied to LANDSAT, ALI, U of Arizona

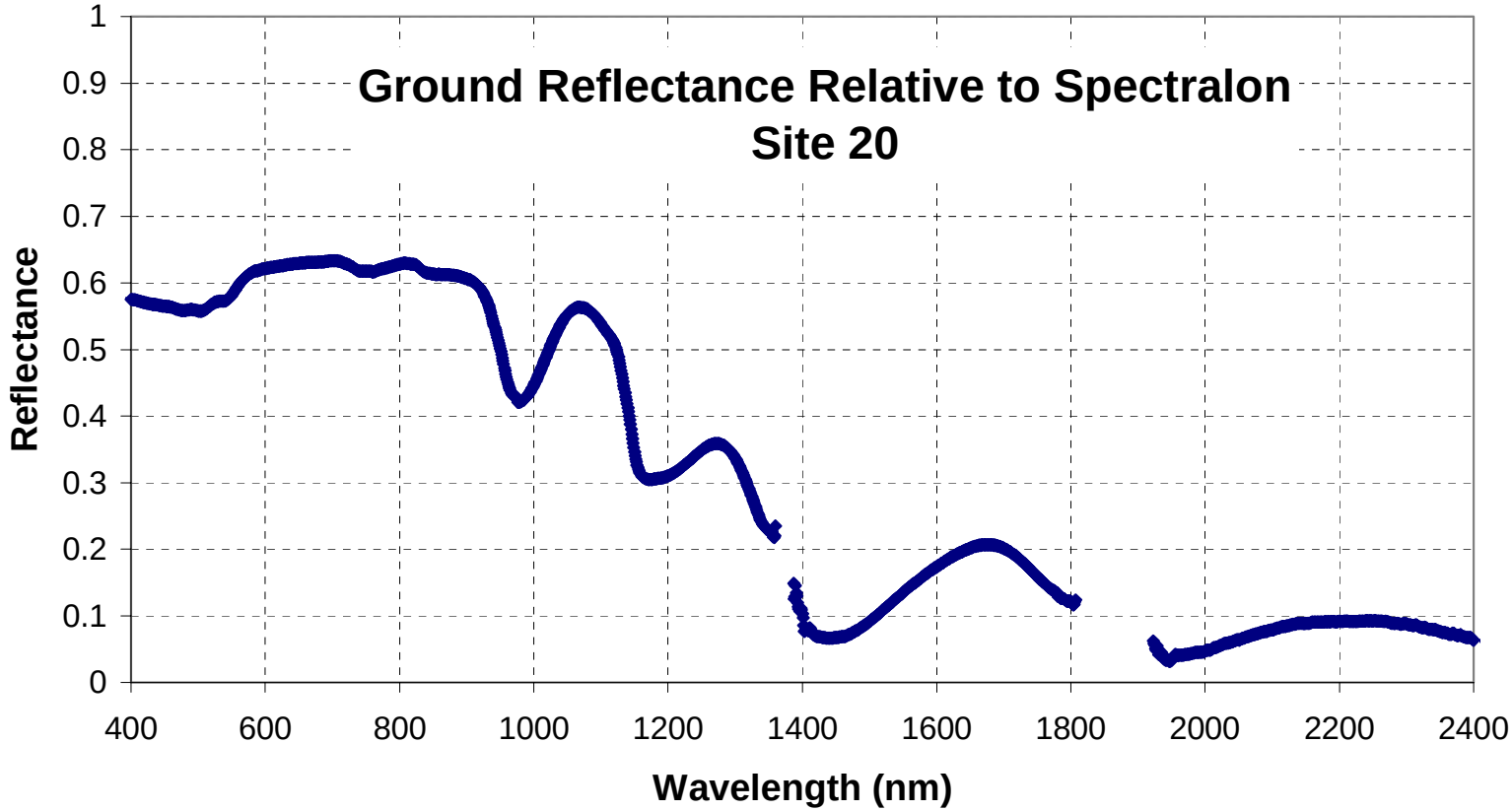
Key Factors Impacting Calibration

	Absolute Knowledge	***Intermediate Properties***	***Spacecraft Pointing***	***Strengths***
Solar Calibration	*Models avail to community* *VNIR more accurate then SWIR*	*Diffuse reflectance of Hyperion cover*	*Critical to modeling intermediate properties*	*Uniform across field-of-view* *Constant*
Lake Frome (vicarious)	*Based on ground truth measurements*	*Atmospheric effects must be modeled*	*Depends on surface*	*User oriented effort*
Lunar Calibration	*Based on Lunar models*	*none*	*Spacecraft scans moon. Relative moon, sun, sat angle*	*No intermediate properties. Constant*

Lake Frome Comparison Process

High resolution ground reflectance measurements referenced to spectralon

Convolved with Hyperion Bandwidth and sampled at Hyperion center wavelength

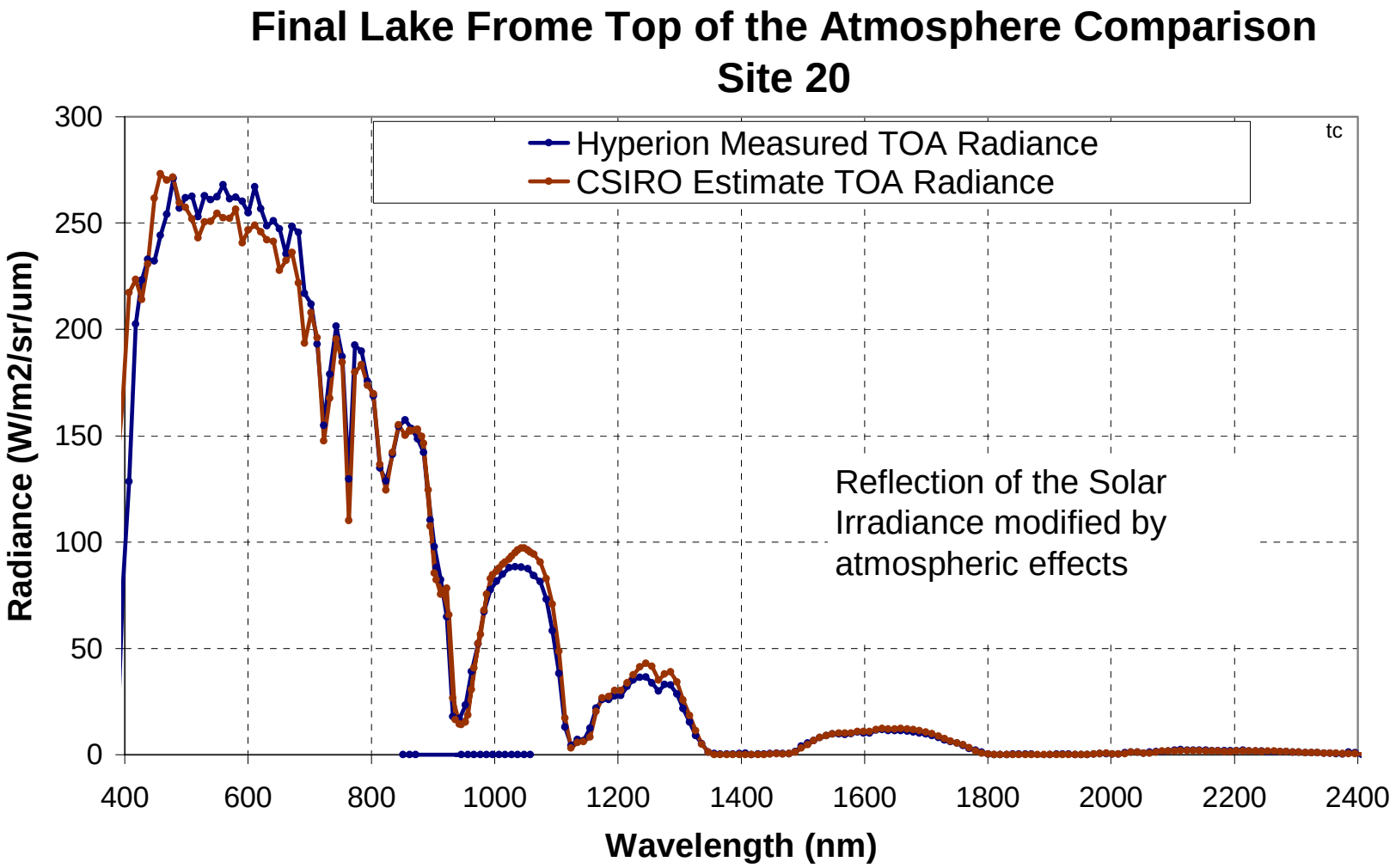


Sites 18,20,22,24 used for preliminary comparisons.
Fall along the same cross track pixel.

Lake Frome Comparison Process

Modeling of atmosphere enabled transfer to Top Of the Atmosphere Comparison

Geo-location identified Hyperion pixel location



Lake Frome Comparison Process

Name	Date	Lat.	Lon.
018	Uniform Salt	-30.80	139.68
020	Uniform Salt	-30.83	139.67
022	Mixed Salt and Mottle	-30.87	139.66
024	Uniform Salt	-30.90	139.65

Ground Location

Hyperion image was geo-located with the ground control points to enable direct comparison

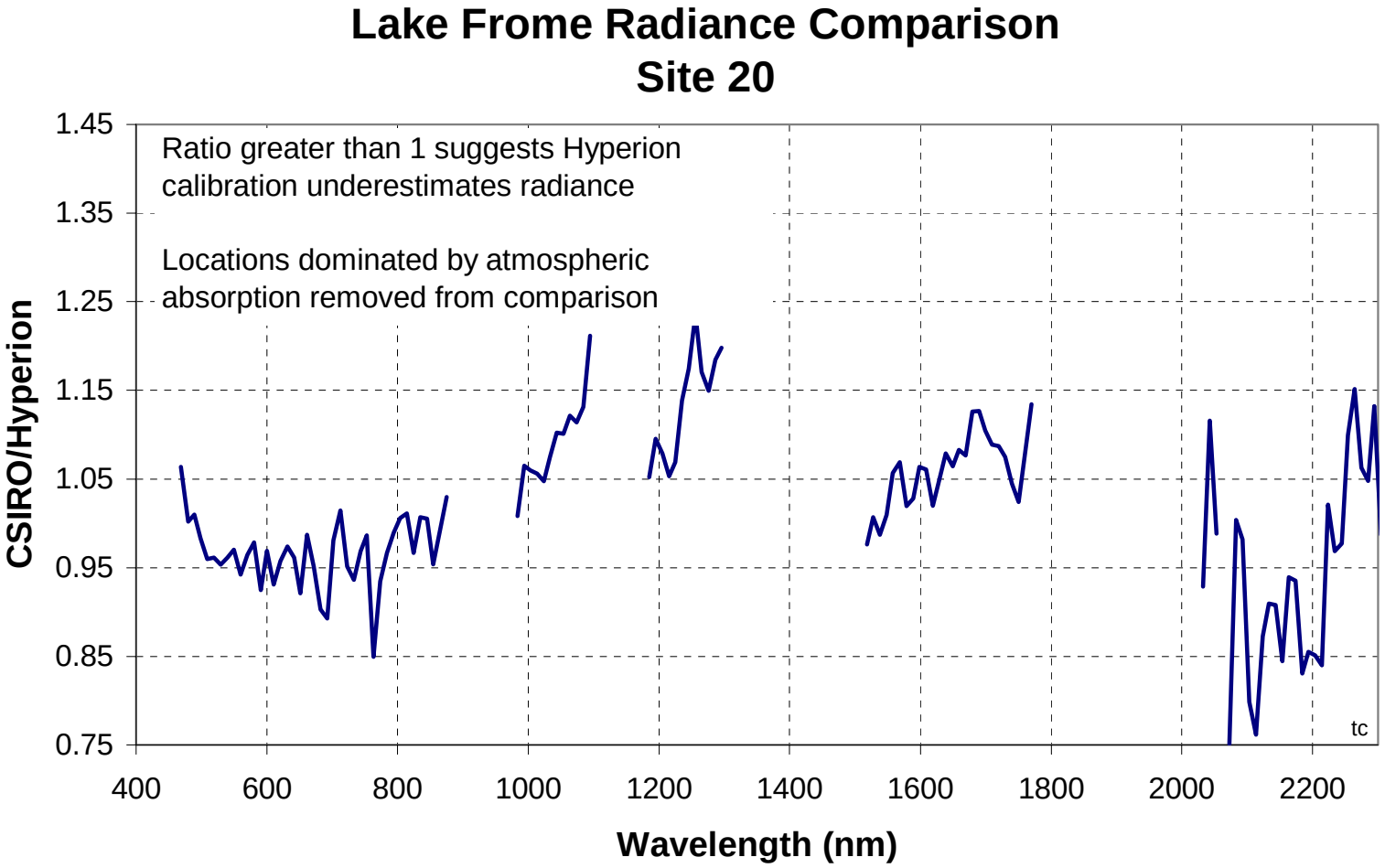
Corresponding Hyperion Pixel

	VNIR Pixel	***VNIR Line***	***SWIR Pixel***	***SWIR Line***
Site 18	107	2219	108	2219
Site 20	107	2343	108	2434
Site 22	107	2467	108	2467
Site 24	108	2592	109	2591

Lake Frome Comparison Process

Top of the Atmosphere Comparison sampled at the Hyperion center wavelength used to make radiance comparison

Compare results with results obtained with the solar calibration

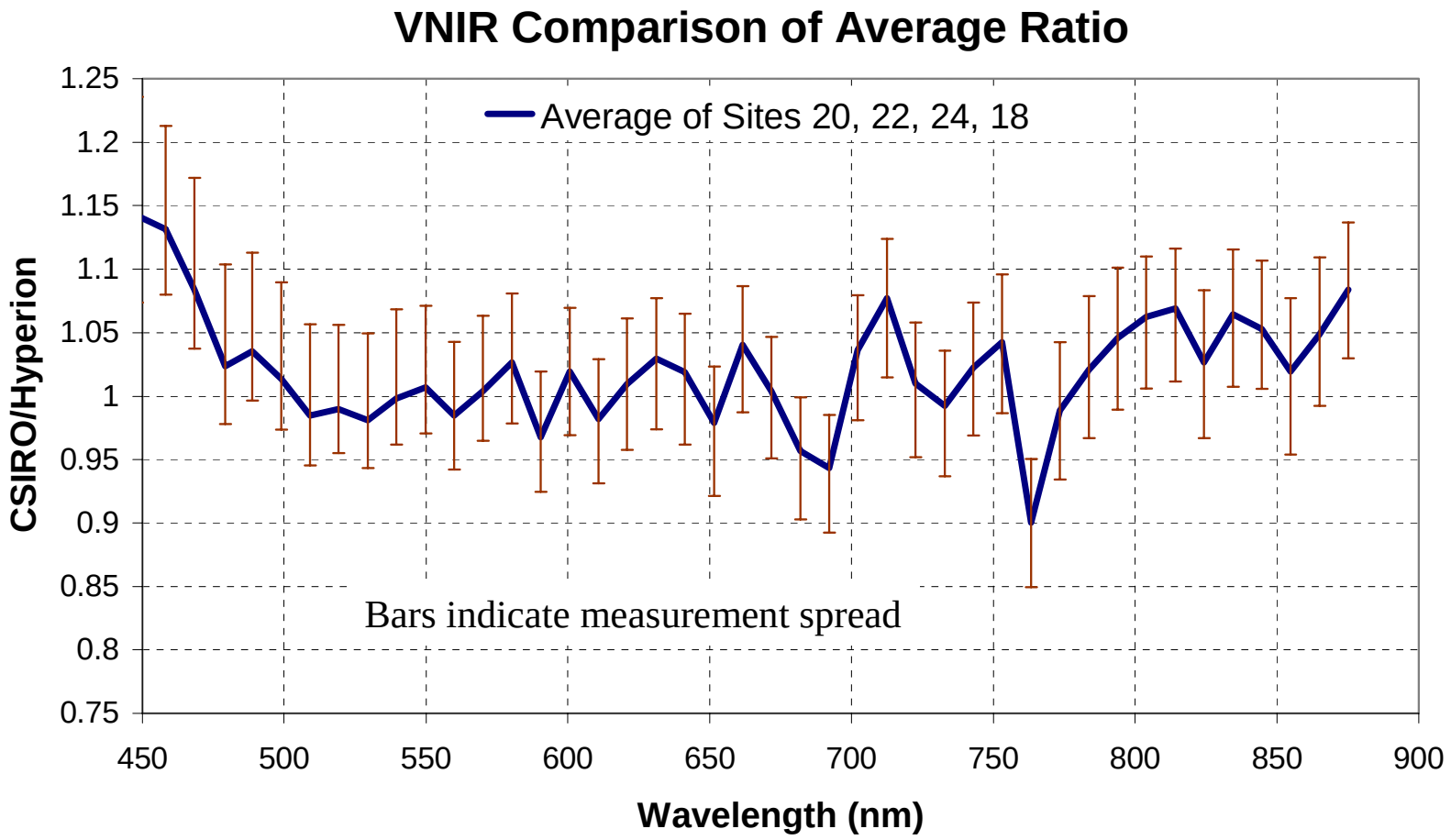


Comparison in the VNIR

Site 20&22 suggests Hyperion high, Site 18&24 suggest Hyperion low, Range +- 5%

Hyperion agreed to solar profile to +- 2%

Lake Frome verification at +-5% level in the VNIR

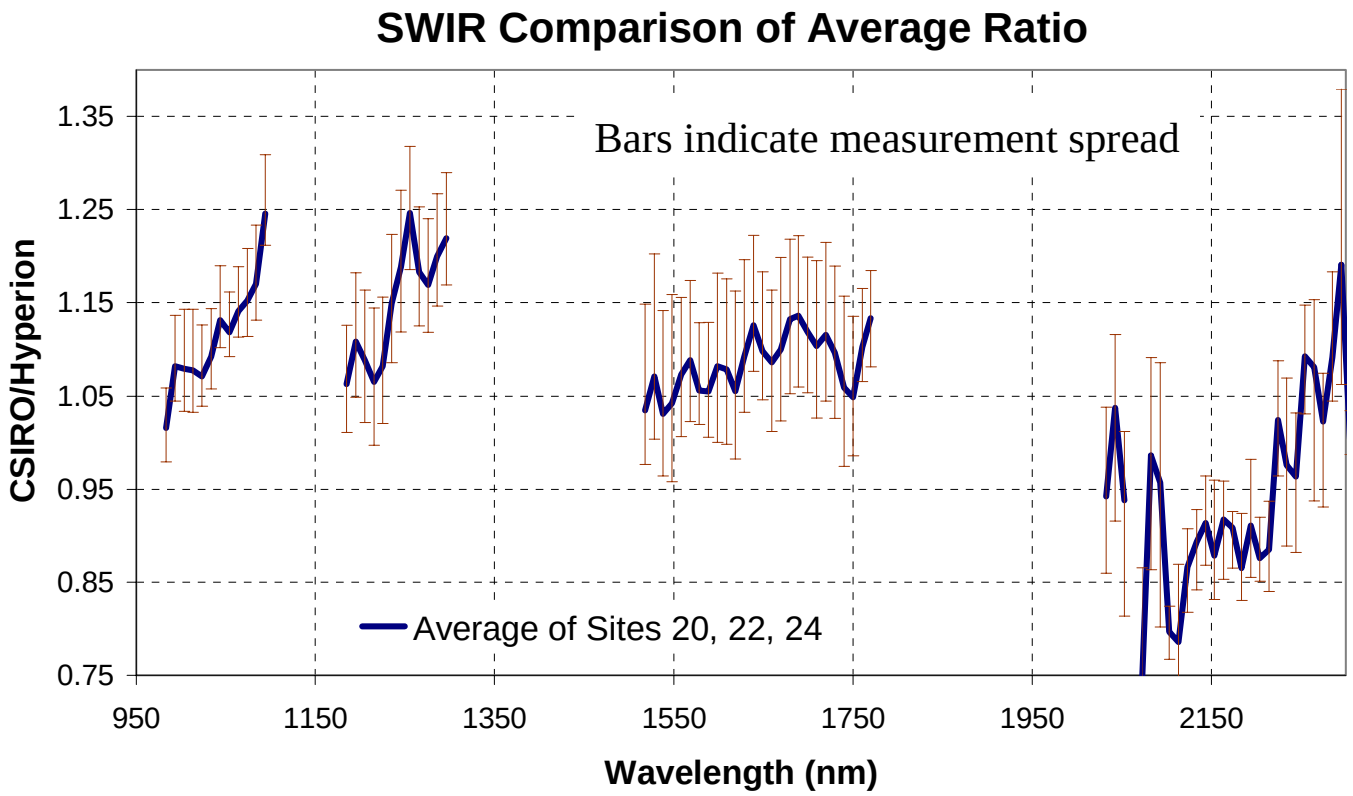


Comparison in the SWIR

Results vary based on Site and wavelength

Suggest variability in Ground Truth measurement since single field-of-view location

Hyperion was 5-8% lower the solar profile



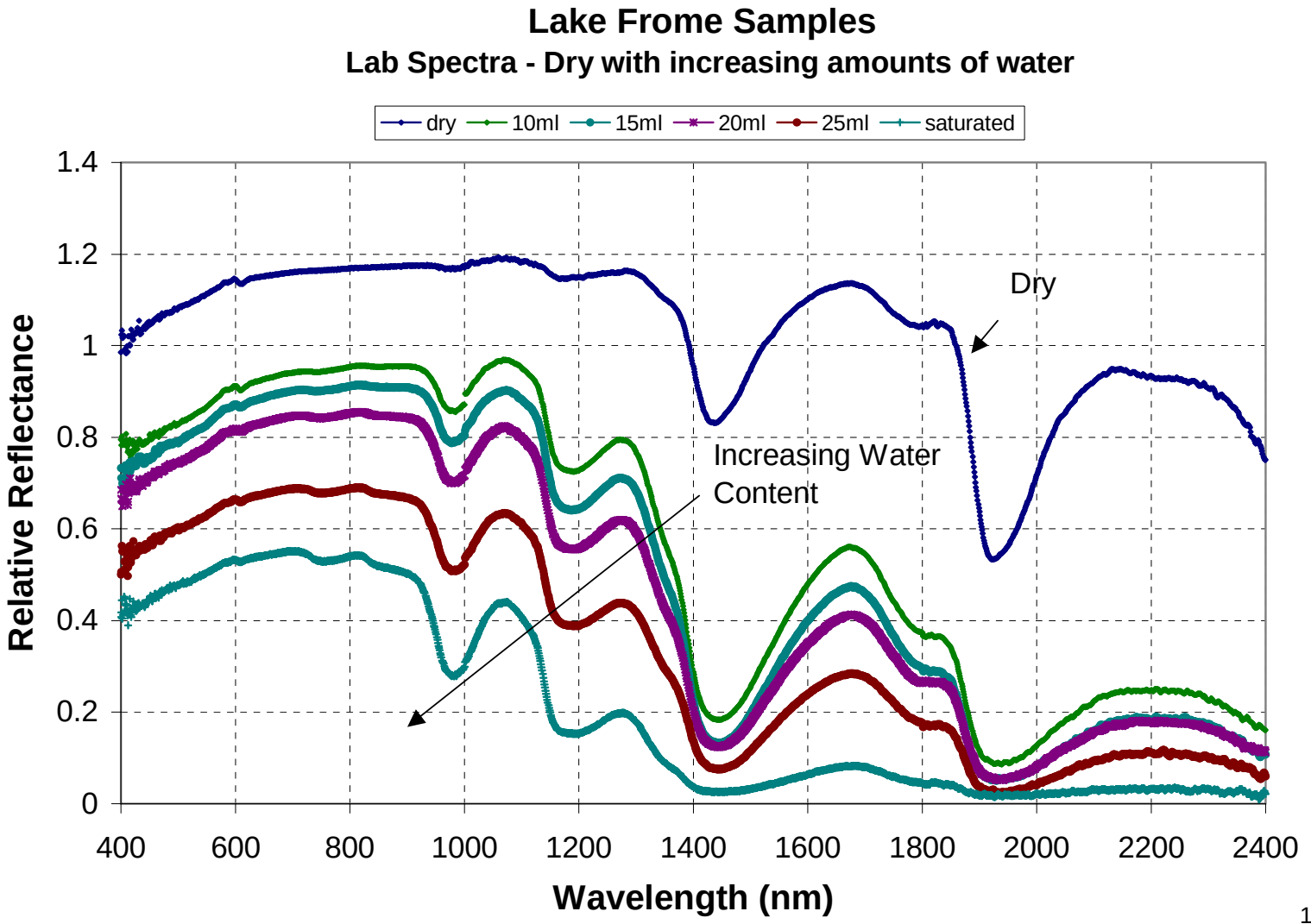
Ground Error sources: BRDF variations, impurity of site, water content, measured reflectance, site percent variation

Not Coincident collect: Ground truth performed 12-19-01 and Hyperion pass was 1-05-01, weather conditions different. Atmospheric correction based on atmosphere measurements made on 1-05-01.

Atmospheric Estimate Based on a Solar Constant

Impact of Moisture on Salt Signature

Approximate lab analysis indicates changes of spectral signature based on amount of water added



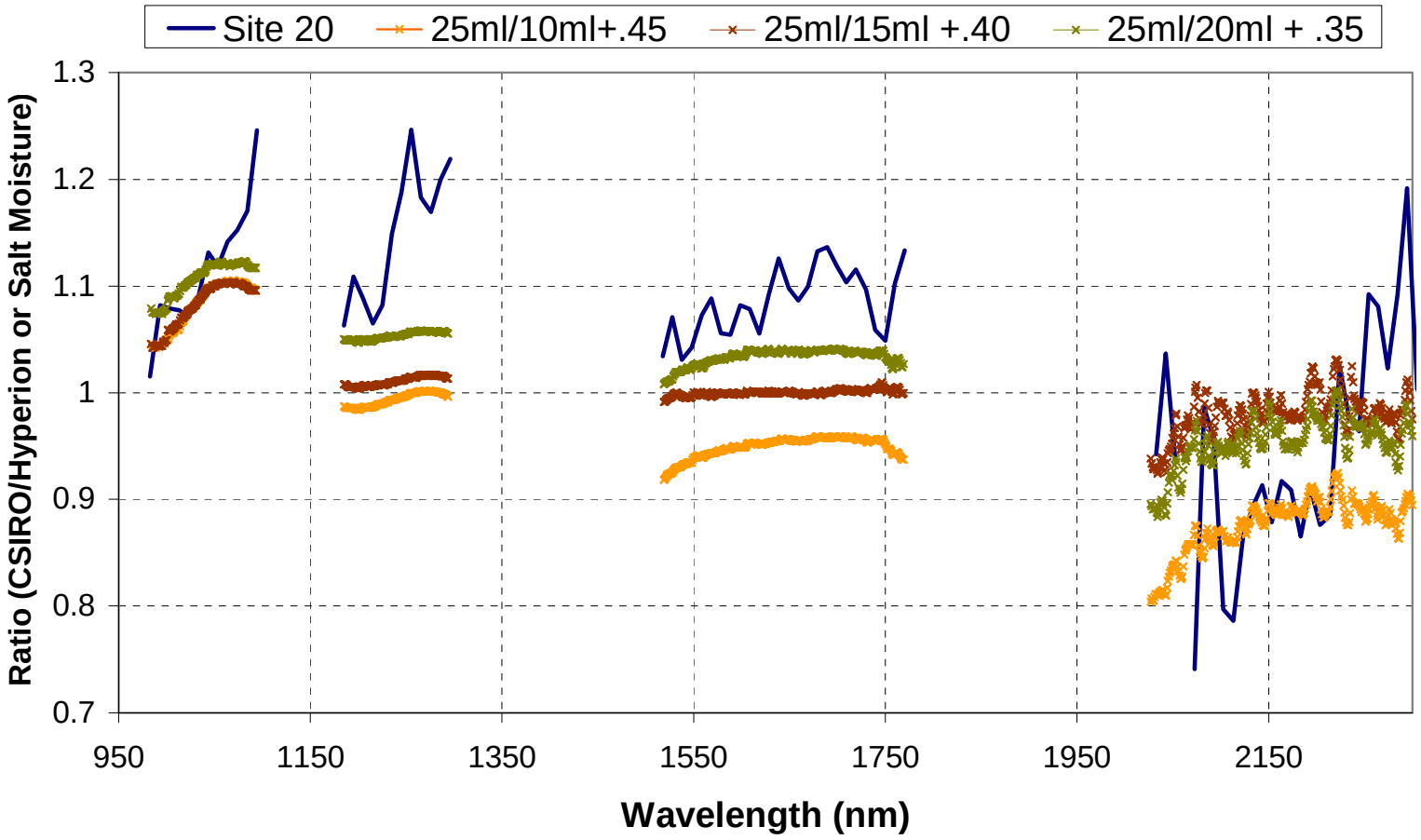
Impact of Moisture on Salt Signature

Analysis supports theory of spectral dependence being related to a change in moisture content

Salt drier for Hyperion overpass (Jan. 5th 2001) then the conditions during ground campaign (Dec. 20th 2000)

Consistent with weather pattern seen in the area

Comparison of TOA SWIR Ratio with Salt Moisture Ratio

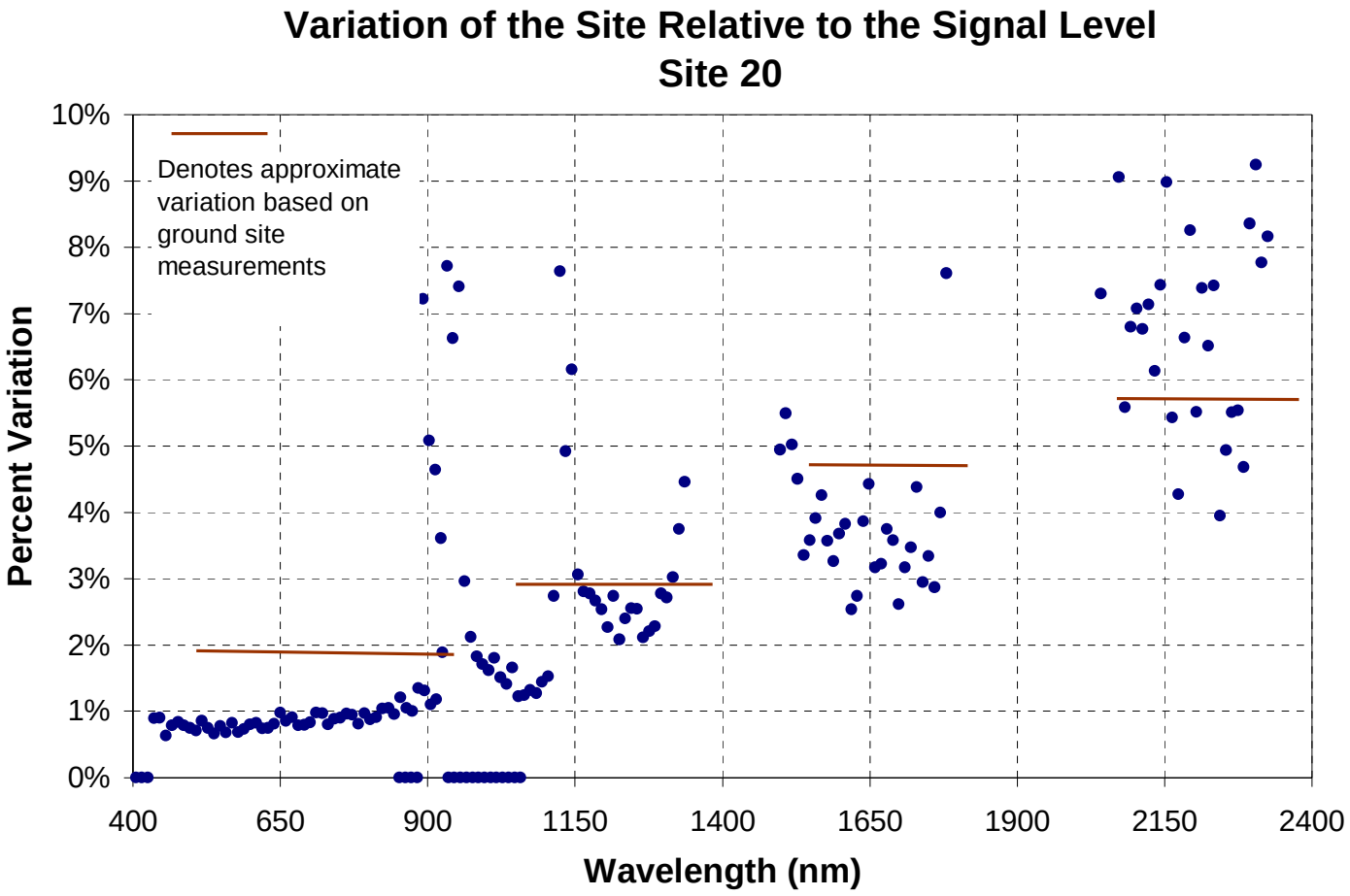


Variation of Site

Variation in VNIR regime varies < 1% of signal

Variation in SWIR regime increases as with wavelength

Typical percent variation of each site



Significant Performance Verification Contributions

Precise geo-location was critical in finalizing the Hyperion VNIR – SWIR coregistration

Geo-location with other platforms enables cross comparisons. January 20th collect to be used for cross-platform comparisons

Effort revealed the importance of identifying the solar model used in the atmospheric modeling codes

Analyzed data set from user perspective

Lake Frome Conclusions

Lake Frome supported the VNIR calibration, details of the SWIR comparison continue to be reviewed.

Used to confirm VNIR-SWIR co-registration and enables cross-platform comparisons with Landsat 7 and potential others

Large site with a strong signal in the VNIR and lower signal in the SWIR, complements other calibration sites

Work in process with additional cross-platform comparisons planned and additional measurements scheduled for September

Ground Truth – How Times Have Changed

1900 - Lake Frome - HH Tilbrook

"The photo, taken in the rain and gale, shows the tent bellying out with the guy rope stiff as an iron bar …"
H. H. Tilbrook

2000 - Lake Frome